FEM 1.209:050053/987

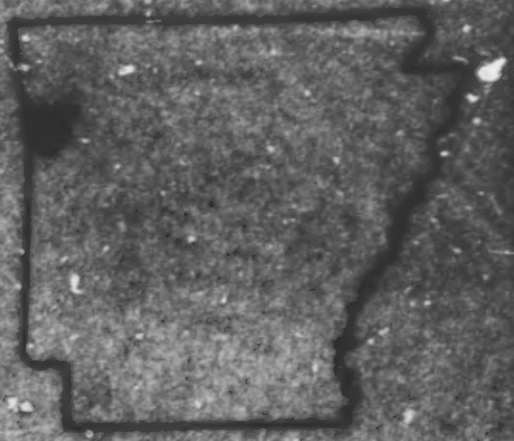
FLOOD INSURANCE STUDY

COMPLETED

38

ORIGINAL

CITY OF VAN BUREN, ARKANSAS CRAWFORD COUNTY



AUGUST 4, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 050053

BEST COPY AVAILABLE

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

BEST COPY AVAILABLE

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgements	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	4
	2.4 Flood Protection Measures	5
3.0	ENGINEERING METHODS	6
	3.1 Hydrologic Analyses	7
	3.2 Hydraulic Analyses	8
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	9
	4.1 Flood Boundaries	9
	4.2 Floodways	10
5.0	INSURANCE APPLICATION	11
6.0	FLOOD INSURANCE RATE MAP	17
7.0	OTHER STUDIES	17

BEST COPY AVAILABLE

TABLE OF CONTENTS - continued

	Page
8.0 LOCATION OF DATA	17
9.0 BIBLIOGRAPHY AND REFERENCES	17

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	15

TABLES

Table 1 - Summary of Discharges	7 - 8
Table 2 - Floodway Data	12 - 14

EXHIBIT

Exhibit 1 - Flood Profiles	
Arkansas River	Panel 01P
Flat Rock Creek	Panels 02P-04P
Town Branch	Panels 05P-07P
Town Branch Overflow	Panel 08P
Lee Creek	Panel 09P
Exhibit 2 - Flood Insurance Rate Map Index and Street Index	
Flood Insurance Rate Map	
Exhibit 3 - Elevation Reference Marks	

BEST COPY AVAILABLE

FLOOD INSURANCE STUDY
CITY OF VAN BUREN, CRAWFORD COUNTY, ARKANSAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Van Buren, Crawford County, Arkansas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses performed by the Little Rock District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 19, and Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 1. The work for the original study was completed in June 1976. The updated version was prepared by the Little Rock District of the COE for FEMA, under Inter- Agency Agreement No. EMW-84-E-1506, Project Order No. 1, Amendment No. 7. This work was completed in January 1985.

1.3 Coordination

On July 20, 1983, streams requiring detailed study were identified at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the City of Van Buren, and the Little Rock District of the COE (the study contractor). The City of Van Buren and the Soil Conservation Service (SCS) were contacted for information pertinent to this study.

BEST COPY AVAILABLE

On August 11, 1986, the results of the study were reviewed at a final CCO meeting held with representatives of FEMA, the city, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Van Buren, Crawford County, Arkansas. Two small areas of Crawford County, which lie within the corporate limits of Van Buren, are not included in this study. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods within the community: the Arkansas River, for its entire length within the community; Flat Rock Creek, from river mile 1.16 to river mile 7.76; Town Branch, from river mile 1.14 to river mile 5.71; Town Branch Overflow, for its entire length within the community; and Lee Creek, from river mile 0.00 to river mile 1.80. The stream distances for this study are measured in river miles instead of actual miles. River miles identify known locations along the streams in the City of Van Buren; actual measured miles along the channel may not correspond to given river miles. All detailed streams were updated in this study except for Town Branch upstream of Teddy Street. A shallow flooding area from Intercepting Drain was also studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through January 1990.

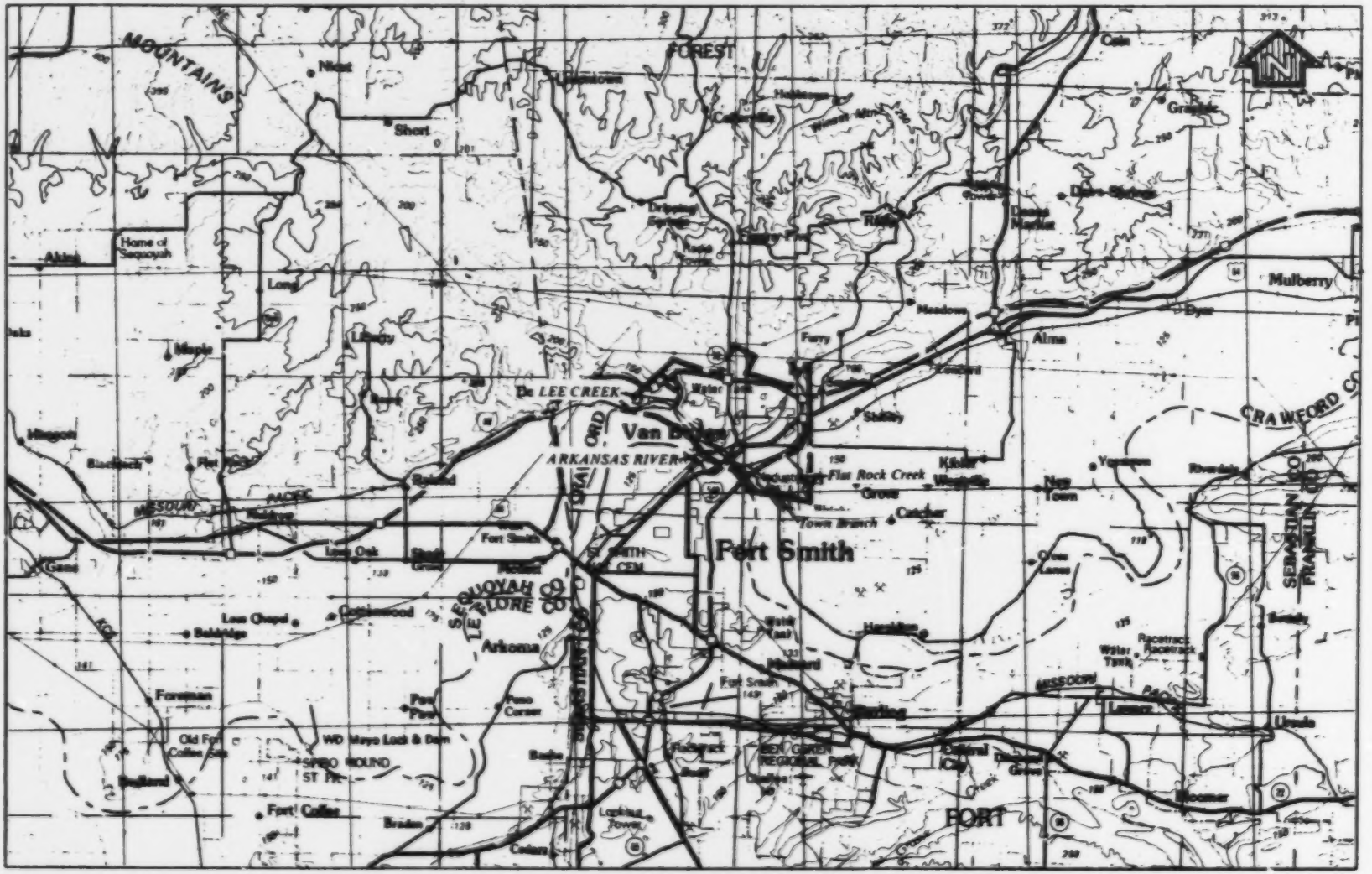
Portions of Flat Rock Creek and Lee Creek were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Van Buren.

2.2 Community Description

The City of Van Buren is located in western Arkansas in Crawford County near the Arkansas-Oklahoma state line. Van Buren is bounded on the south and southwest by the Arkansas River. It is bordered by the City of Fort Smith, located across the Arkansas River, to the southwest and the unincorporated areas of Crawford County on all other sides.

The City of Van Buren is a residential and industrial community that has grown from a population of 5,422 in 1940 to 6,787 in 1970, to 8,373 in 1970, to 12,020 in 1980, and to an estimated 13,230 in 1984. The city is

BEST COPY AVAILABLE


MOUNTAINS
FOREST
Short
Home of Sequoyah
Akins
Long
Maple
Liberty
Be LEE CREEK
Van Buren
ARKANSAS RIVER
Flat Rock Creek
Grove
Town Branch
Catcher
Fort Smith
Port Smith
SMITH CEM
Mulberry
Alma
Dyer
Meadow
Ferry
Shibley
Kibler
Westville
New Town
CRAWFORD CO
SEBASTIAN CO
FRANKLIN CO
SEQUOYAH CO
LEFLORE CO
Arkoma
Cottonwood
Law Chapel
Belaridge
Foreman
Old Fort Coffee Site
WD Mayo Lock & Dam
SHRO ROUND ST Pk
Fort Coffee
Braden
Lookout Tower
Hackett
Hamilton
Barling
Fort Smith
Racetrack
Water Tank
Lavaca
Uniola
Bloomer
Oxford Cem
Dogwood Gdns
BEN GARDEN REGIONAL Park
PORT
Rudy
Pine Corner
Pine Park
Cedars
Rudyard
Blackrock
Flat Rock
Redrock
Missouri Pacific
Missouri
Long Oak
Shady Grove
Rudyard
Gans
Maybelle
Blackrock
Redrock
Rudyard
Cedars
Braden
Lookout Tower
Fort Coffee
Old Fort Coffee Site
Foreman
Belaridge
Law Chapel
Cottonwood
Arkoma
Fort Smith
Hackett
Barling
Hamilton

located entirely within the Arkansas River watershed. Most of the City of Van Buren is drained by Flat Rock Creek and Town Branch, which join near the southeast corner of the city. The western end of the city is drained by Lee Creek.

Industrial development is expanding into the southeast portion of the city and into the western portion of the city along the Arkansas River. New residential development is generally located in the central and northern part of the city. Residential flood plain development within Van Buren consists of low- to moderate-priced homes along Town Branch. Most of the city is not subject to flooding; however, some areas are within the flood plains of the Arkansas River, Town Branch, Flat Rock Creek, and Lee Creek. New commercial and residential development is occurring along each of these streams. The Arkansas River flood plain and Van Buren Industrial Park have experienced strong growth pressures.

The climate of Van Buren is humid with an average annual temperature of 61 degrees Fahrenheit (°F). Summers are moderately long and hot, and daily maximum temperatures occasionally exceed 100°F. Winters are moderately short and cold. The average annual precipitation for the area is approximately 48 inches. Precipitation is evenly distributed throughout the year, with heavier amounts occurring in the spring and lesser amounts in the summer. Intense thunderstorms do occur in the summer and may release large amounts of rain over a small area in a short period of time. The area receives a light snowfall of approximately 5 inches annually.

The topography of Van Buren ranges from hilly to flat with land elevations varying from approximately 780 feet in the west to approximately 390 feet in the southeast.

2.3 Principal Flood Problems

Prior to 1949, when the present government-built levee was completed, the City of Van Buren suffered heavy losses when floods on the Arkansas River overtopped or outflanked local levees that only gave partial protection against floods. During the period from 1900 to 1949, local levees failed or were ineffective in June 1904, April 1927, June 1935, February 1938, November 1941, May 1943, and April 1945. The most severe flooding occurred in May 1943 when more than 20 city blocks were inundated.

Present flood problems in Van Buren are the greatest in the gently sloping areas located in the south and southwest part of the city, resulting from local runoff that exceeds the channel capacities of Flat Rock Creek and Town Branch. Inadequate bridge and culvert openings add to flood heights during large floods. Flooding along the Arkansas River affects developments on the river side of the levee and floodwall; it

BEST COPY AVAILABLE

also causes backwater flooding on Lee Creek in the western part of the city. There are no gage records and only a few high-water marks available to indicate the frequency and extent of flood damages within the leveed area. High water on the Arkansas River also affects flood staqes along Intercepting Drain because floodgates through the levee are closed that normally discharge directly into the river. When the gates are closed, this water is diverted into an overloaded storm sewer and results in greater amounts of flow along Intercepting Drain.

Continuous records of river stages on the Arkansas River at the Van Buren gage are available from April 1879 to December 1955. Fragmentary records and a number of high water elevations at this location are available from as far back as the 1830's. Continuous records of river stages and discharges on the Arkansas River at Van Buren are available since October 3, 1927, when the U. S. Geological Survey (USGS) installed a chain gage on the U. S. Route 64-71 bridge. On July 5, 1934, the chain gage was replaced by a recording gage. The crest readings of the Fort Smith and Van Buren gages generally read within 1 foot of each other during the period when both were in operation except during extremely large floods when the Van Buren reading was considerably higher.

Discharges and elevations from the headwater and tailwater gages at Lock and Dam No. 13 are available for the period since the navigation pool was raised in December 1969. This station has replaced the Van Buren gage for this portion of the Arkansas River.

In conjunction with the USGS, the Little Rock District of the COE installed three stream gaging stations and three rain gaging stations in the Fort Smith area. Also, the rain gage at Lock and Dam No. 13 on the Arkansas River was reactivated. This was all completed by September 1980. Rainfall records for the Fort Smith-Van Buren area have been available since 1882.

The upstream reaches of the Flat Rock Creek watershed are rapidly developing. This will require good flood plain management to avoid flood damages since increased runoff will occur.

2.4 Flood Protection Measures

Except for a small undeveloped area adjacent to the Lee Creek arm of Pool 13, the City of Van Buren is protected against flooding from the Arkansas River by the Van Buren Levee and Floodwall that was constructed by the COE. FEMA specifies that all levees must have a minimum of 3 feet of freeboard against 100-year flooding to be considered a safe flood protection structure. The Van Buren Levee and Floodwall meets the FEMA freeboard requirement.

BEST COPY AVAILABLE

The Van Buren Levee and Floodwall was designed to provide 3 feet of freeboard above the unmodified Standard Project Flood. The Standard Project Flood is a hypothetical flood intended to represent the most severe combination of flood parameters that is reasonably characteristic of this region. Since construction of the levee in the late 1940's, a number of upstream flood control storage projects have been completed on the Arkansas River and its tributaries. At this time, there are 26 reservoir projects with designated flood control storage amounting to 10,710,000 acre-feet upstream from Van Buren. These projects provide partial control of floods over 142,317 square miles of the 150,482 square miles of contributing area upstream from the Van Buren gage. These projects reduce peak discharges greatly and provide additional freeboard for the Van Buren levee system. No frequency was assigned to the unmodified Standard Project Flood used for design for the levee grade as there are insufficient hydrological and meterological data available to make a reliable estimate of exceedence probabilities or recurrence intervals for floods of the magnitude of a Standard Project Flood on the Arkansas River.

The SCS constructed a floodwater retarding structure in January 1982 on Town Branch approximately at river mile 5.7 with a drainage area of 228 acres. In conjunction with the floodwater retarding structure, Town Branch Channel was completed in August 1983 from Oak Grove Road downstream to its mouth.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

BEST COPY AVAILABLE

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The hydrologic analysis for the Arkansas River was obtained from the detailed and extensive engineering studies that have been previously made in connection with the design, construction, and maintenance of the McClellan-Kerr Arkansas River Navigation System. Continuous records of river stages on the Arkansas River at the Van Buren gage are available from 1879 to present. These flood data were investigated to determine the discharge frequency used in the study, and they were adjusted as required for the effects of the appropriate upstream storage reservoirs.

Discharges for Flat Rock Creek, the portion of Town Branch downstream of Teddy Street, and Town Branch Overflow were determined using the COE HEC-1 computer program (Reference 1). A peak discharge frequency curve was computed for Lee Creek using gage data. This frequency curve was computed using USGS Bulletin 17B (Reference 2). The discharges for Lee Creek were obtained from this curve.

Information for Town Branch upstream of Teddy Street and Intercepting Drain were obtained from the previously effective Flood Insurance Study for the City of Van Buren (Reference 3). Peak discharges for Intercepting Drain were derived from use of the Rational Method since the watershed is less than 1 square mile in drainage area.

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ARKANSAS RIVER					
At U. S. Route 64	149,972	280,000	405,000	470,000	540,000
FLAT ROCK CREEK					
At river mile 2.21	17.0	6,670	9,980	11,540	15,670
TOWN BRANCH					
At the confluence of Town Branch Overflow	2.4	1,400	1,500	1,550	1,650

BEST COPY AVAILABLE

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TOWN BRANCH OVERFLOW					
At the Missouri-Pacific Railroad (river mile 1.04)	*	170	480	690	1,350
LEE CREEK					
At USGS gage (river mile 7.8)	426	58,000	96,000	114,000	162,000
INTERCEPTING DRAIN					
At mouth	0.27	500	650	710	840

*Not applicable

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of the streams studied by detailed methods were developed by field surveys. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

The flood profile for Town Branch for the portion of study downstream of Teddy Street and the portion of study upstream of Teddy Street do not match exactly due to the updated hydrologic analysis performed for the downstream portion; however, the elevations have been joined at Teddy Street in order to provide a continuous profile.

Although a detailed study was made on Intercepting Drain, no profiles were drawn or cross sections shown since only shallow flooding, 1 foot in depth or less, occurs in this drain. In the lower reaches of the drain, flooding is caused by backwater from Town Branch.

BEST COPY AVAILABLE

Roughness factors (Manning's "n") used in the hydraulic computations were obtained by engineering judgment and field investigations of the streams and flood plain areas. The channel "n" and overbank "n" values for the streams studied by detailed methods are shown in the following tabulation:

Stream	Channel "n"	Overbank "n"
Arkansas River	0.018-0.030	0.075
Flat Rock Creek	0.035-0.050	0.080-0.100
Town Branch	0.040-0.055	0.080-0.130
Town Branch Overflow	0.060	0.060
Lee Creek	0.030	0.080

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 4). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the streams studied by detailed methods were determined by the slope/area method.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year flood plain boundaries and 100-year floodway to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and

BEST COPY AVAILABLE

500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with contour intervals of 10 and 20 feet (Reference 5). Flood boundaries in the Industrial Park were delineated using 1-foot contour interval maps provided by the city. The flood boundaries for Town Branch downstream of the Missouri Pacific Railroad (at river mile 3.37) were delineated using 1-foot contour interval topographic maps produced by the COE in conjunction with the design of the McClellan-Kerr Arkansas River Navigation System.

For the areas studied by approximate methods, the boundaries of the 100-year flood were delineated using the previously effective Flood Insurance Study for the City of Van Buren (Reference 3).

The 100- and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE), and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

BEST COPY AVAILABLE

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the flood plain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodway is shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway widths for the Arkansas River, Flat Rock Creek, and Lee Creek extend beyond the corporate limits. The reach of Intercepting Drain upstream from the railroad, which is dominated by sheet flow, does not meet the floodway concept and is not listed in Table 2.

The floodway along the Arkansas River cannot encroach in the normal pool since it would affect the operations of Lock and Dam No. 13. In addition, encroachments in the pool would cause forces for which the structure was not designed. The Arkansas River floodway between cross sections A and B provides for these necessary requirements. In addition, the Interstate Route 540 and U. S. Route 71-U. S. Route 64 relief openings within the city limits of Fort Smith have been included in the floodway. This is required to assure that filling from development will not change or block flow through these structures.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 2 for certain downstream cross sections of Lee Creek are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

BEST COPY AVAILABLE

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Arkansas River								
A	298.62[1]	7155/1815[4]	139,427	3.4	409.9	409.9	410.9	1.0
Flat Rock Creek								
A	1.621[2]	1877/260[4]	12,671	0.9	395.2	395.2	396.1	0.9
B	2.930[2]	699/215[4]	4,498	2.6	405.6	405.6	406.3	0.7
C	3.585[2]	802	5,823	2.0	408.2	408.2	409.1	0.9
D	3.912[2]	531	3,954	2.9	409.7	409.7	410.6	0.9
E	4.127[2]	501	5,032	2.3	412.0	412.0	412.7	0.7
F	4.746[2]	284	1,998	5.7	415.8	415.8	416.2	0.4
G	5.051[2]	158	1,428	8.0	418.9	418.9	419.6	0.7
H	6.150[2]	346	2,039	4.3	430.2	430.2	431.1	0.9
I	6.694[2]	251/0[4]	2,058	4.4	444.3	444.3	444.4	0.1
J	7.000[2]	98	998	9.0	448.9	448.9	449.1	0.2
K	7.222[2]	97	608	14.4	453.8	453.8	453.8	0.0
L	7.646[2]	143/70[4]	850	10.3	471.3	471.3	471.6	0.3
M	7.756[2]	114	828	10.6	476.2	476.2	477.1	0.9
Town Branch								
A	1.252[3]	156	1,002	1.5	398.0	398.0	398.3	0.3
B	1.738[3]	163	1,154	1.3	399.6	399.6	400.2	0.6
C	2.045[3]	157	1,108	1.4	399.8	399.8	400.4	0.6
D	2.668[3]	417	2,521	1.1	401.4	401.4	402.0	0.6
E	2.787[3]	412	2,400	1.1	404.0	404.0	404.5	0.5

[1]River miles above confluence with Mississippi River
[2]River miles above confluence with Hollis Lake
[3]River miles above confluence with Ned Lake
[4]Width/width within corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR
(CRAWFORD CO.)

FLOODWAY DATA

ARKANSAS RIVER — FLAT ROCK CREEK — TOWN BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Town Branch (continued)								
F	2.900	687	5,544	0.5	404.2	404.2	405.1	0.9
G	3.135	583	3,620	0.7	406.3	406.3	407.2	0.9
H	3.270	221	1,331	2.0	406.4	406.4	407.3	0.9
I	3.435	277	2,206	1.4	409.3	409.3	409.7	0.4
J	3.482	142	690	4.4	409.3	409.3	409.7	0.4
K	3.623	287	2,047	1.5	411.0	411.0	411.6	0.6
L	3.830	237	1,681	1.7	411.8	411.8	412.6	0.8
M	3.961	130	899	3.2	412.3	412.3	413.0	0.7
N	4.114	132	916	2.9	415.1	415.1	416.1	1.0
O	4.398	129	640	3.4	423.5	423.5	424.5	1.0
P	4.509	185	1,835	1.2	425.0	425.0	425.8	0.8
Q	4.801	135	693	3.2	432.4	432.4	433.4	1.0
R	5.048	111	696	3.2	440.8	440.8	441.1	0.3
S	5.188	68	215	10.2	445.1	445.1	445.1	0.0
T	5.328	140	529	2.3	458.1	458.1	458.6	0.5
U	5.433	362	1,269	0.9	461.9	461.9	462.7	0.8
V	5.706	33	186	6.5	484.5	484.5	485.1	0.6

[1]River miles above confluence with Ned Lake

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR
(CRAWFORD CO.)

FLOODWAY DATA

TOWN BRANCH

BEST COPY AVAILABLE

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Town Branch Overflow								
A	0.578[1]	208	584	0.2	396.0	396.0	397.0	1.0
B	0.709[1]	454	1,320	0.3	399.4	399.4	400.2	0.8
C	0.968[1]	467	1,661	0.2	399.4	399.4	400.2	0.8
Lee Creek								
A	0.262[2]	404	11,579	9.8	411.9	409.4[4]	410.4	1.0
B	0.649[2]	375	10,207	11.2	411.9	410.1[4]	410.9	0.8
C	1.420[2]	650	14,724	7.7	413.5	413.5	414.3	0.8
D	1.799[2]	1213/460[3]	23,240	4.9	414.9	414.9	415.9	1.0

[1]River miles above confluence with Flat Rock Creek
[2]River miles above confluence with Arkansas River
[3]Width/width within corporate limits
[4]Elevation computed without consideration of backwater from Arkansas River

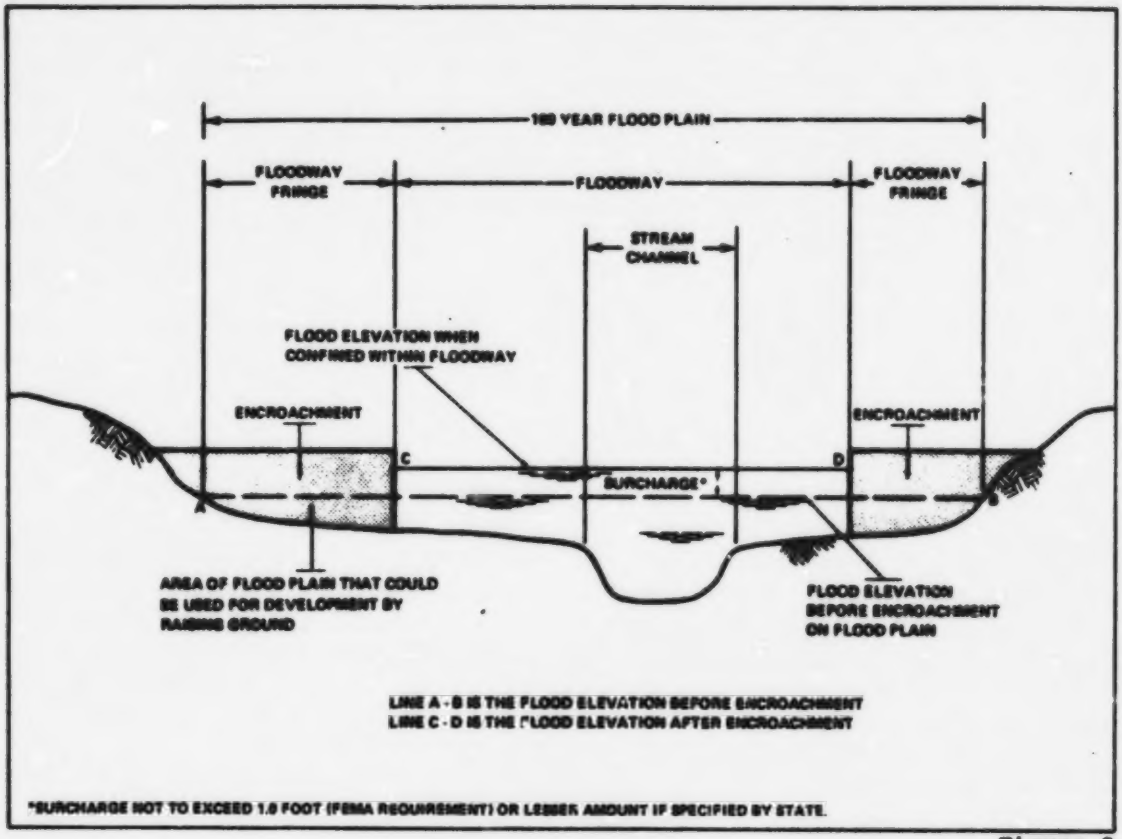
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR
(CRAWFORD CO.)

FLOODWAY DATA

TOWN BRANCH OVERFLOW — LEE CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown in this area.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

BEST COPY AVAILABLE

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year flood plain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Zone V areas are determined by approximate methods, and base flood elevations are not shown.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, and to areas of 100-year shallow flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown.

BEST COPY AVAILABLE

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year flood plains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Flood Insurance Study for the City of Fort Smith has been published (Reference 6). The results of this study are in exact agreement with the results of that study.

The SCS completed a study of channelization and floodwater retention of Flat Rock Creek and Town Branch (Reference 7). The information in this study was coordinated with the SCS study.

Due to its more up-to-date analyses, this study supersedes the previously effective Flood Insurance Study for the City of Van Buren (Reference 3).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Davis, California, July 1982.

BEST COPY AVAILABLE

2. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

3. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Van Buren, Crawford County, Arkansas, Washington, D. C., October 27, 1981.

4. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, March 1982.

5. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet with intermittent 10 Feet: Fort Smith, Arkansas-Oklahoma, Photorevised 1978; Van Buren, Arkansas, Photorevised 1978.

6. Federal Emergency Management Agency, Flood Insurance Study, City of Fort Smith, Sebastian County, Arkansas, Washington, D. C., August 19, 1986.

7. U. S. Department of Agriculture, Soil Conservation Service, Final Work Plan, Flat Rock Creek Watershed, Crawford County, Arkansas, Washington, D. C., January 1976.

U. S. Army Corps of Engineers, Little Rock District, Town Branch Overflow Restudy, Little Rock, Arkansas, May 1980.

U. S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, Washington, D. C., 1961, Revised 1963.

BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	05	408.12	TMB on painted rock north of northwest corner of bridge crossing Lee Creek on left bank at Van Buren Waterworks.
RM 2	05	413.97	Bench mark on top of left bank of the Arkansas River at river mile 303.3, 42 feet south of Missouri Pacific Railroad tracks, 10 feet north of power lines.
RM 3	05	405.25	Bench mark on top of left bank of the Arkansas River at river mile 303, set 2 feet from 14-inch cottonwood tree, 8 feet south of field road.
RM 4	05	404.04	Bench mark on top of left bank of the Arkansas River at river mile 302.7, 4 feet east of 36-inch cottonwood tree, 25 feet north of field road.
RM 5	05	414.24	TBM approximately 0.8 foot above downstream side of abutment at west end of St. Louis-San Francisco Railway bridge over Lee Creek.
RM 6	05	406.34	Bench mark between two steel fence posts on top of left bank of the Arkansas River east of mouth of Lee Creek at Arkansas River mile 302.2, 6 feet west of field road.
RM 7	05	402.56	Bench mark between two steel fence posts on top of left bank of the Arkansas River at river mile 301.8, 18 feet west of toe of levee, 2 feet west of field road.

BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 8	05	397.59	Bench mark between two steel fence posts on rock revetment, on top of left bank of the Arkansas River at river mile 301.5, 27 feet southwest of field road.
RM 9	10	455.50	Nail in joint at southwest corner of ramp to Interstate Route 40 from Interstate Route 540 crossing Flat Rock Creek.
RM 10	10	441.43	Top of rail at third guard post from southwest corner of Rudy Road bridge crossing Flat Rock Creek, approximately 200 feet north of Interstate Route 40 ramp.
RM 11	10	401.64	Bench mark 15 feet east of top of left bank of the Arkansas River, near river mile 298.6, 3 feet west of last light pole between two orange fence posts, 1,900 feet west of South 28th Street, 1,600 feet south of angle-point in levee.
RM 12	10	417.82	Bench mark on top of levee at angle-point, near Arkansas River mile 298.7, approximately 500 feet west of South 28th Street.

BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 13	10	401.93	Bench mark between two fence posts 10 feet west of power pole on top of left bank of the Arkansas River, near river mile 298.8, at south end of Sand and Gravel Company.
RM 14	10	404.18	Bench mark between two fence posts 80 feet east of top of bank of the Arkansas River, near river mile 299, 3 feet west of 30-inch cottonwood tree.
RM 15	10	398.83	Bench mark between two fence posts 10 feet east of top of left bank of the Arkansas River, approximately 1,400 feet downstream of Interstate Route 540 bridge, 4 feet west of light pole.
RM 16	10	397.44	Bench mark between two fence posts at northwest corner of concrete slab, 15 feet north of left bank of the Arkansas River, approximately 250 feet downstream from Interstate Route 540 bridge, 5 feet south of gravel road.
RM 17	10	404.20	Standard USCE brass cap set in concrete cast in stone pipe stamped VB-8 1955 Little Rock District, approximately 1,200 feet south of Ark-Okla Sand and Gravel Company, approximately 110 feet east of left of bank of the Arkansas River, 371.61 feet west of BM VB-9 set in angle point on levee, 20 feet east of centerline of old road.

BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 18	10	419.34	Standard USCE brass cap set in concrete cast in stone pipe stamped VB-7 1955 Little Rock District, on top of levee at angle point at Ark-Okla Sand and Gravel Company, 77.90 feet west of gap in levee for RR, approximately 800 feet south of northeast end of bridge over Arkansas River.
RM 19	10	412.84	Standard disk stamped VAN BUREN RESET 1941 set in top of concrete post near intersection of North Third and Main Streets, approximately 50 feet west of west corner of courthouse in octagonal plot at intersection of sidewalks and 2 feet southwest of concrete base of sun dial.
RM 20	05	419.76	Standard disk stamped 419.760 T 28 1932 on St. Louis-San Francisco Railway, at bridge 410.6 over Arkansas River, on north side of river, west on track, in top of stone masonry back wall.
RM 21	05	404.34	Bench mark on west end of rock dike along the Arkansas River, at river mile 301.1, approximately 1,300 feet upstream from St. Louis-San Francisco Railway bridge.
RM 22	10	404.75	Top of fire hydrant, 6 feet south of Oak Grove Road at Industrial Aviation Office.

BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 23	10	401.11	Chiseled square on northwest corner of Oak Grove Road bridge crossing Flat Rock Creek.
RM 24	10	414.23	Chiseled square on northwest curb of westbound lane of Interstate Route 540 bridge crossing Flat Rock Creek, 400 feet east of South 28th Street.
RM 25	10	417.68	Chiseled square on northeast inside curb at northeast end of Interstate Route 162 bridge crossing Flat Rock Creek.
RM 26	10	448.01	Chiseled square on curb at east end of Interstate Route 540 bridge, Fort Smith bound lane, crossing Flat Rock Creek, 150 feet south of Missouri-Pacific Railroad.
RM 27	10	421.25	Northwest outside corner of Missouri-Pacific Railroad bridge crossing Flat Rock Creek.
RM 28	10	418.63	Boat spike in utility pole on south side of county road between Interstate Route 540 and Missouri-Pacific Railroad, approximately 50 feet west of end of county road bridge crossing Flat Rock Creek, approximately 5 feet above ground in south side of pole.

BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 29	10	428.88	Chiseled square on inside curb at northwest corner of U. S. Route 64/71 bridge crossing Flat Rock Creek.
RM 30	10	453.35	Chiseled square on southwest corner of westbound lane of Interstate Route 40 bridge from Van Buren crossing Flat Rock Creek.
RM 31	10	399.80	Cross in headwall 5 feet west of nrothwest corner of Missouri-Pacific Railroad bridge crossing Town Branch.
RM 32	10	408.21	Boat spike in east side of utility pole at railroad crossing of Oak Grove Road, 30 feet east of railroad and 20 feet south of road, across from Foreman Cement Plant entrance.
RM 33	10	402.13	Chiseled square at northwest corner of bridge crossing Town Branch on Oak Grove Road.
RM 34	10	413.04	Chiseled square in southwest corner of walk in northwest corner of Chestnut Street crossing Town Branch.
RM 35	10	440.91	Star on top of manhole approximately 100 feet southeast of intersection of 25th and Alma Boulevard.
RM 36	10	482.34	Chiseled square in northeast corner of Maple Street bridge crossing Town Branch.

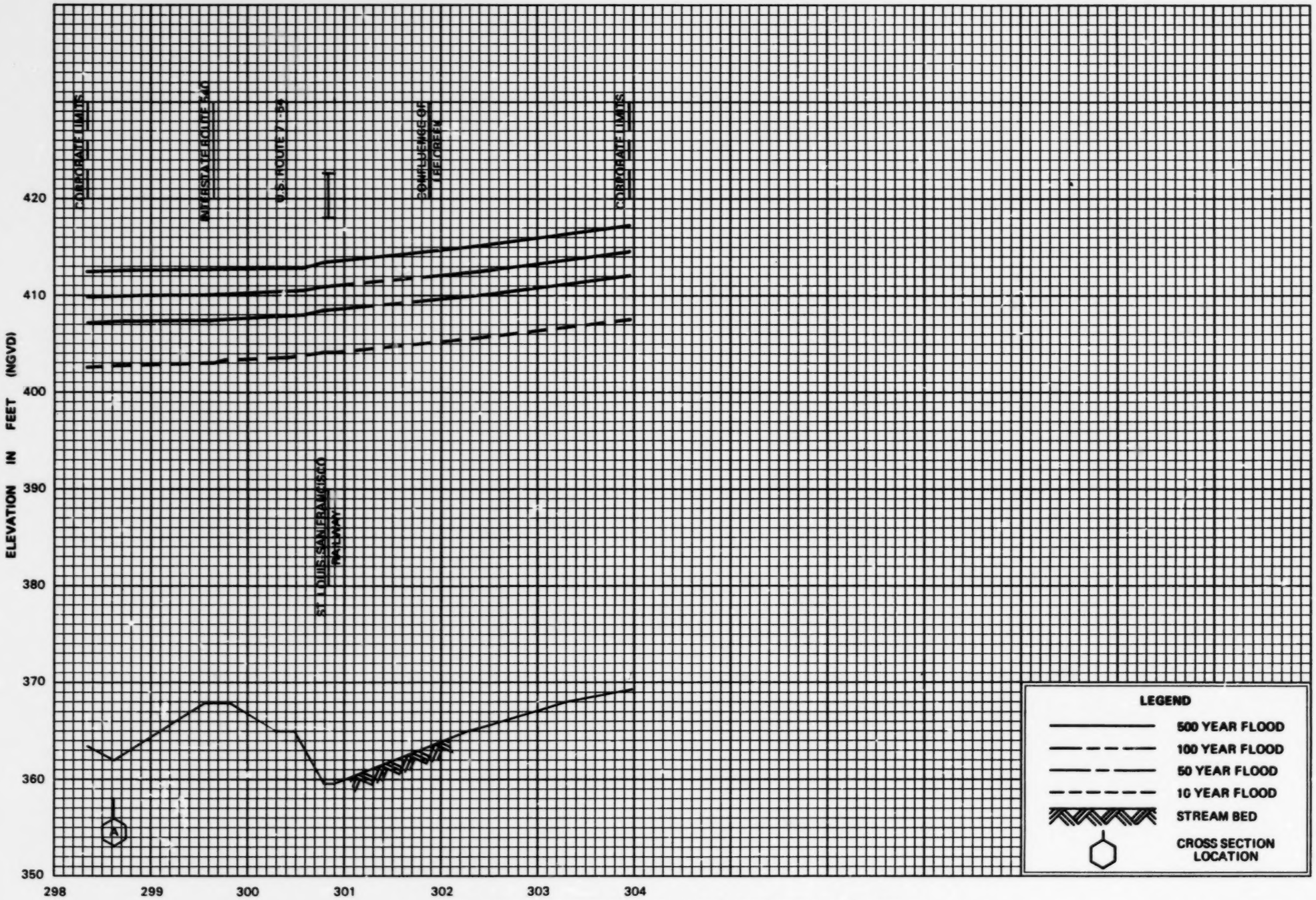
BEST COPY AVAILABLE

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 37	10	403.92	Boat spike in utility pole at south corner of Fourth and Scott Streets.
RM 38	10	403.07	Boat spike in utility pole at south corner of Vine and Third Streets.
RM 39	10	406.98	Top of fire plug at west corner of Third and Broadway Streets.
*RM 40	10	399.91	Brass cap set in top of concrete-filled clay tile on top of left bank of the Arkansas river, 1 foot north of east-west fence, between two fence posts in northeast 1/4 of Section 6 T8N, R31W.
RM 41	05	477.77	Standard disk, stamped 477.768 P 28 1932, set in top of concrete post, approximately 3,600 feet northeast along St. Louis-San Francisco Railway from intersection of Interstate Route 40, 9 1/2 poles southwest of milepost 407, and 40 feet northwest of tracks.

*Outside corporate limits

BEST COPY AVAILABLE



FLOOD PROFILES

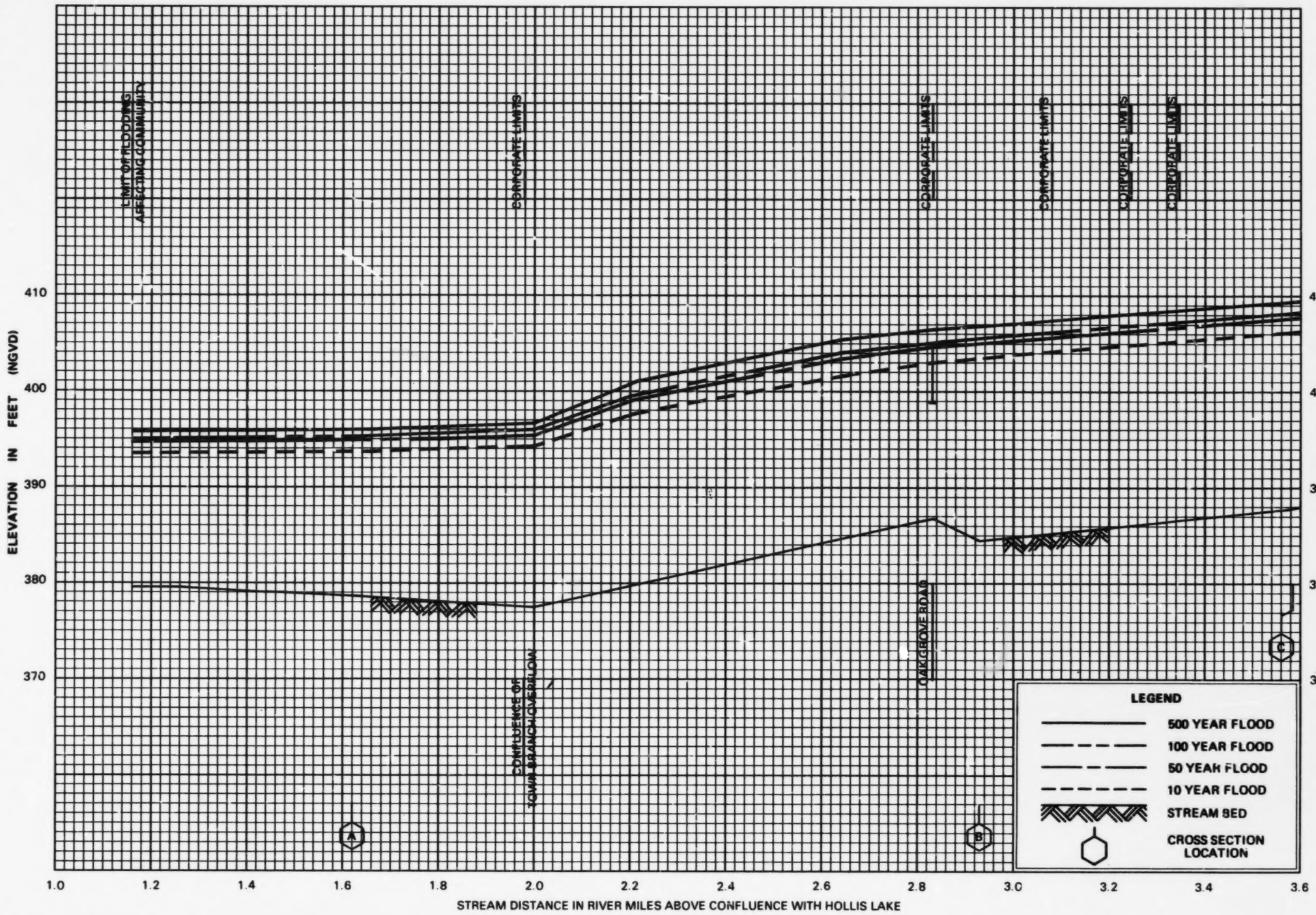
ARKANSAS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR
(CRAWFORD CO.)

01P

BEST COPY AVAILABLE



FLOOD PROFILES

FLAT ROCK CREEK

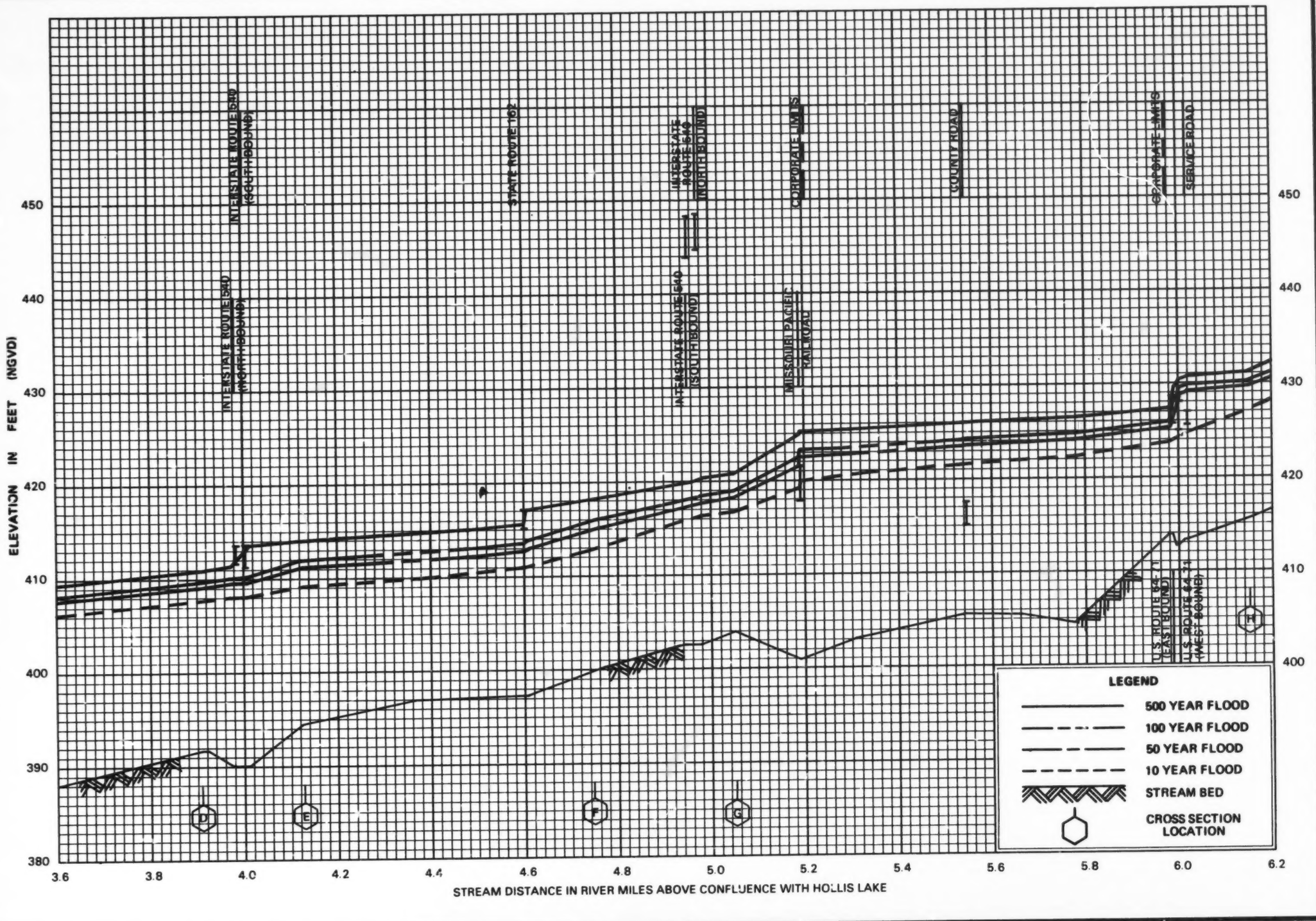
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR

(CRAWFORD CO.)

02P

BEST COPY AVAILABLE



FLOOD PROFILES

FLAT ROCK CREEK

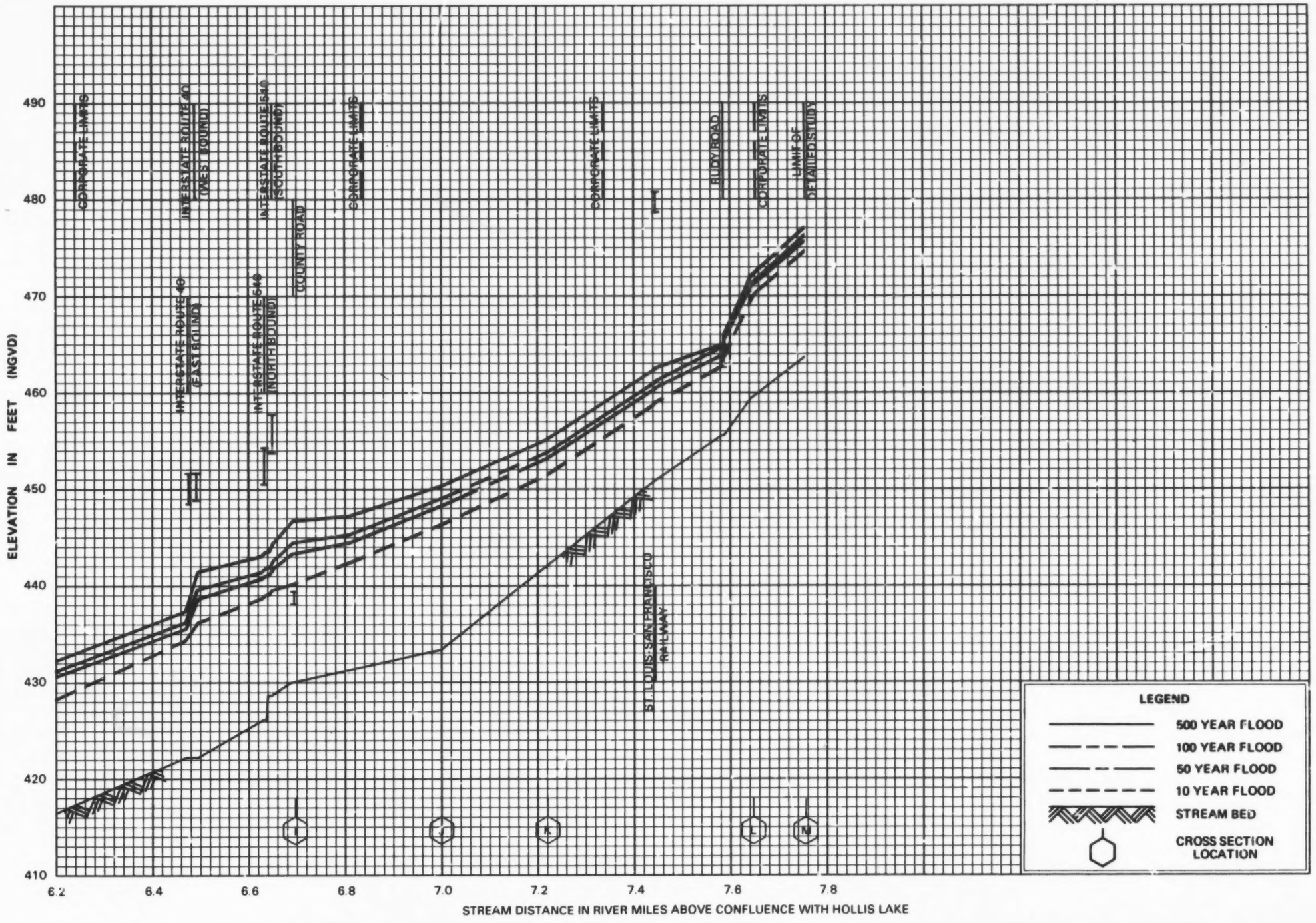
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR

(CRAWFORD CO.)

03P

BEST COPY AVAILABLE



FLOOD PROFILES

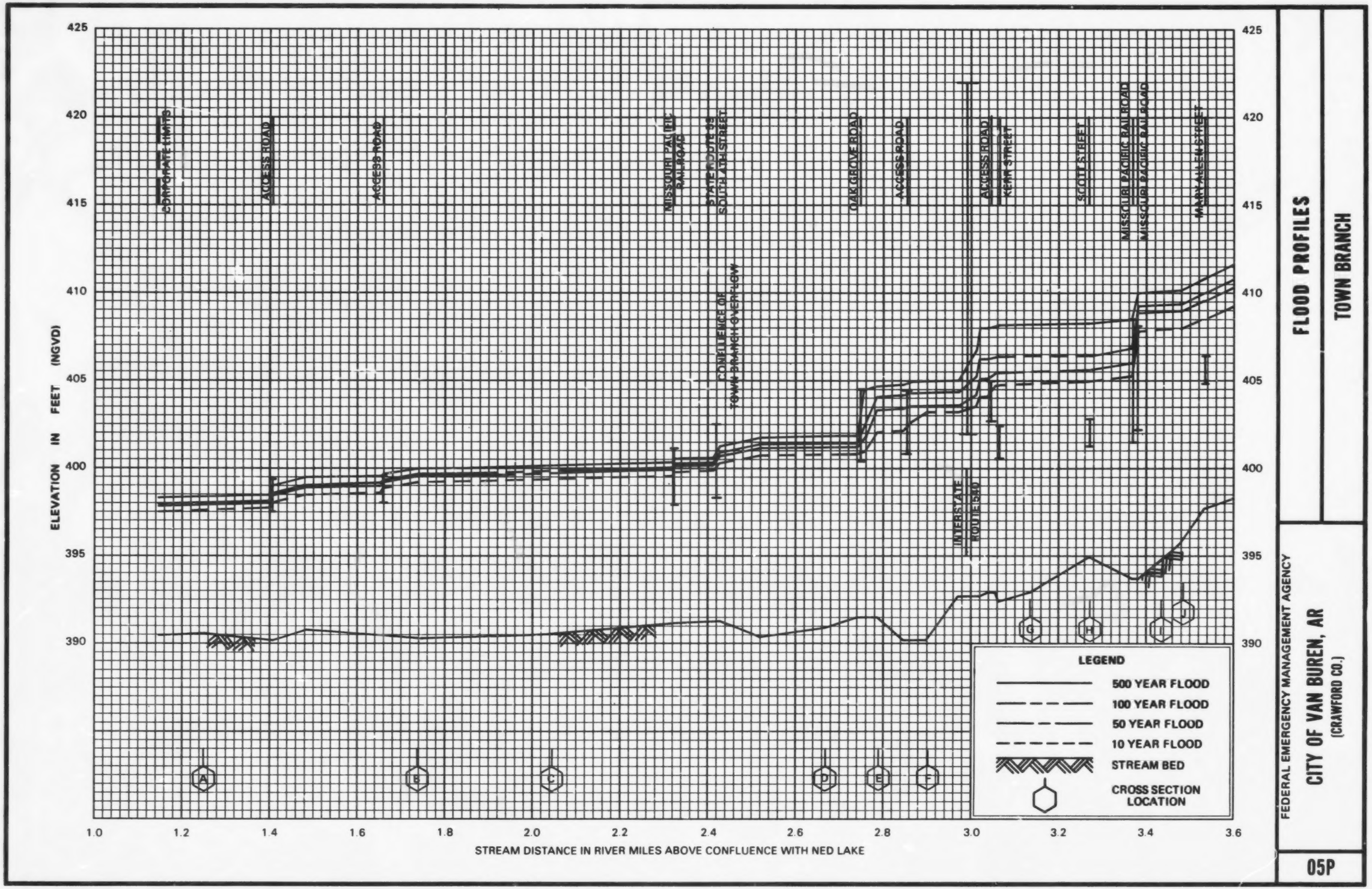
FLAT ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR
(CRAWFORD CO.)

04P

BEST COPY AVAILABLE



FLOOD PROFILES

TOWN BRANCH

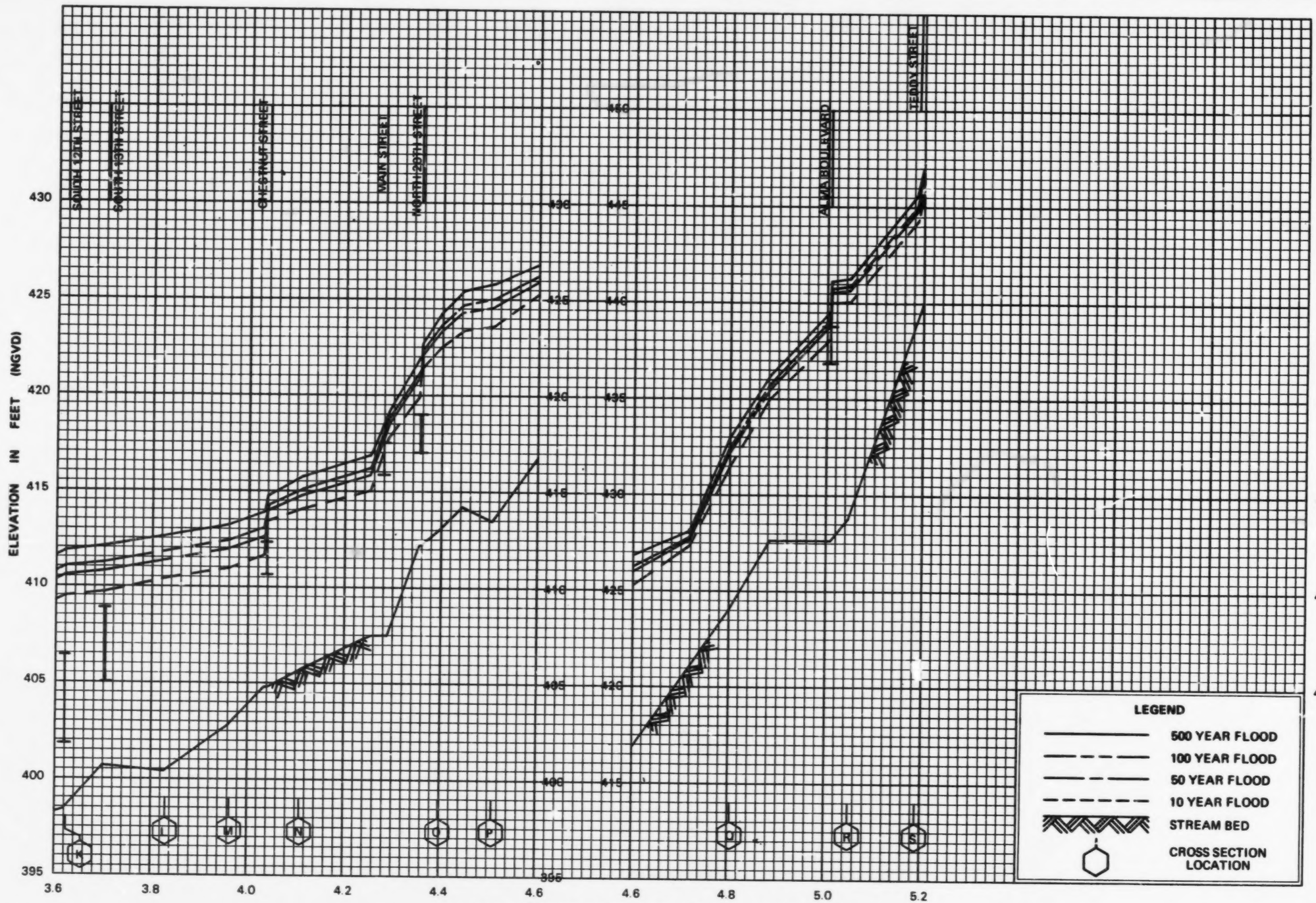
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR

(CRAWFORD CO.)

05P

BEST COPY AVAILABLE



FLOOD PROFILES

TOWN BRANCH

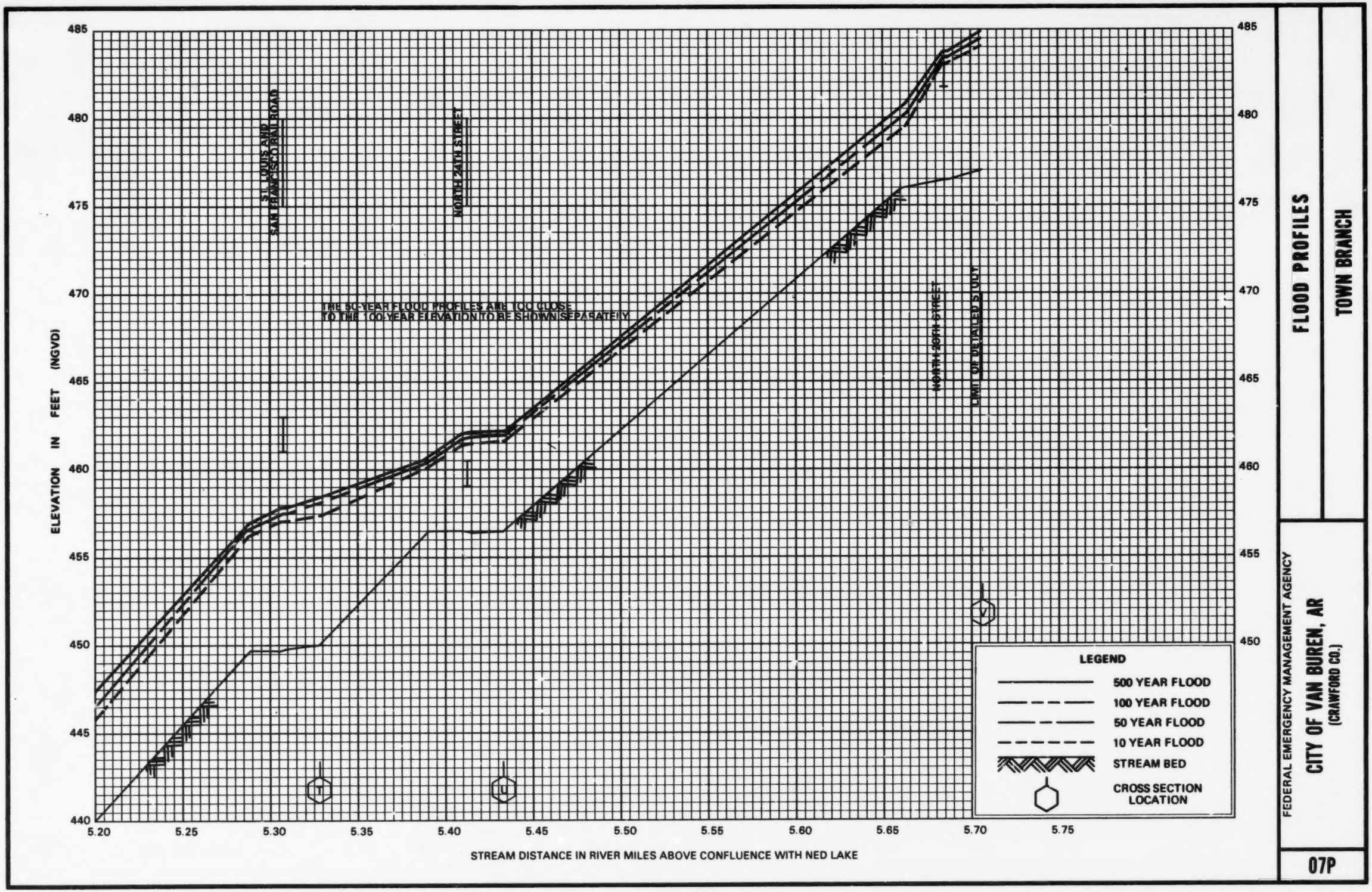
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR

(CRAWFORD CO.)

06P

BEST COPY AVAILABLE



FLOOD PROFILES

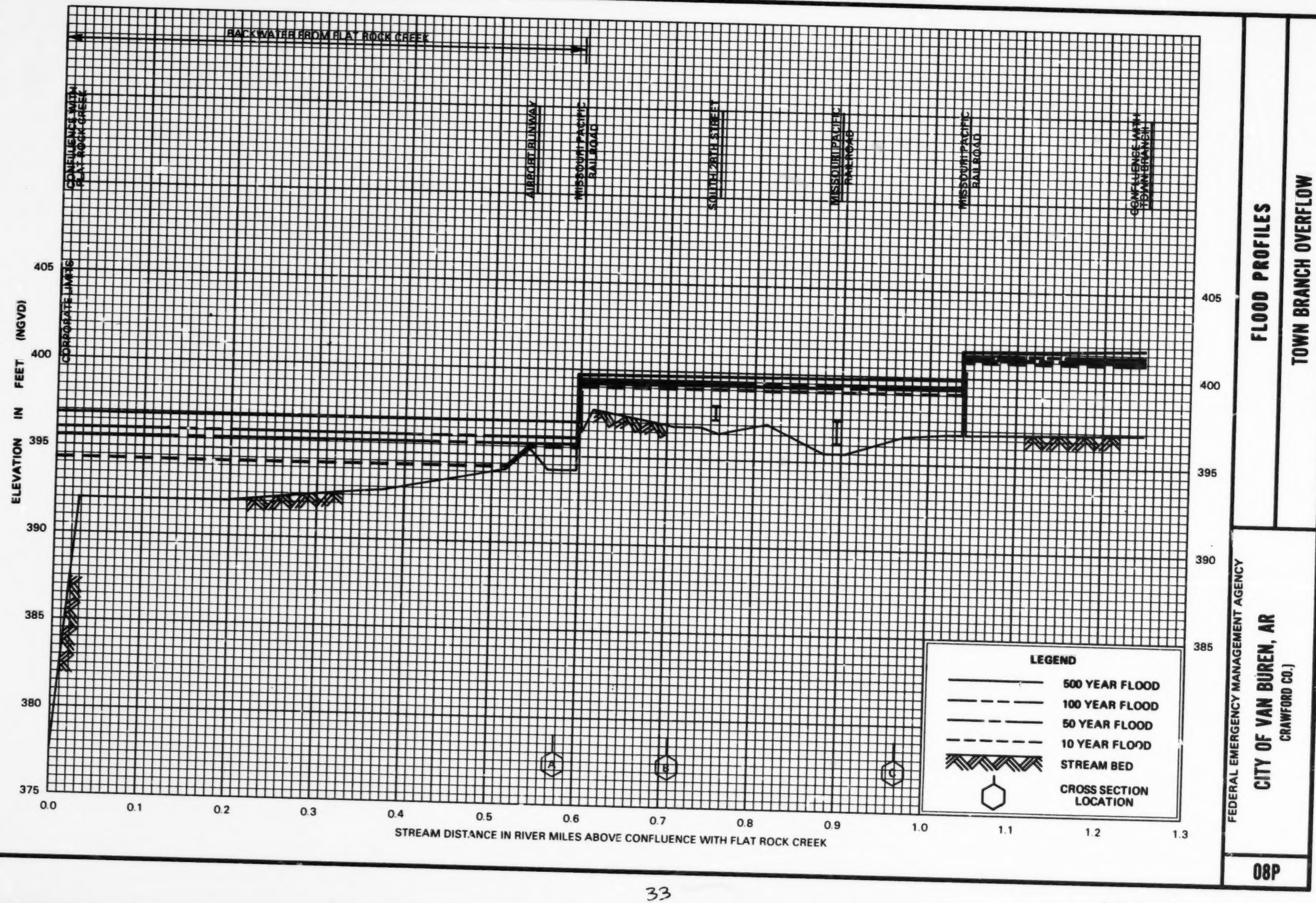
TOWN BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

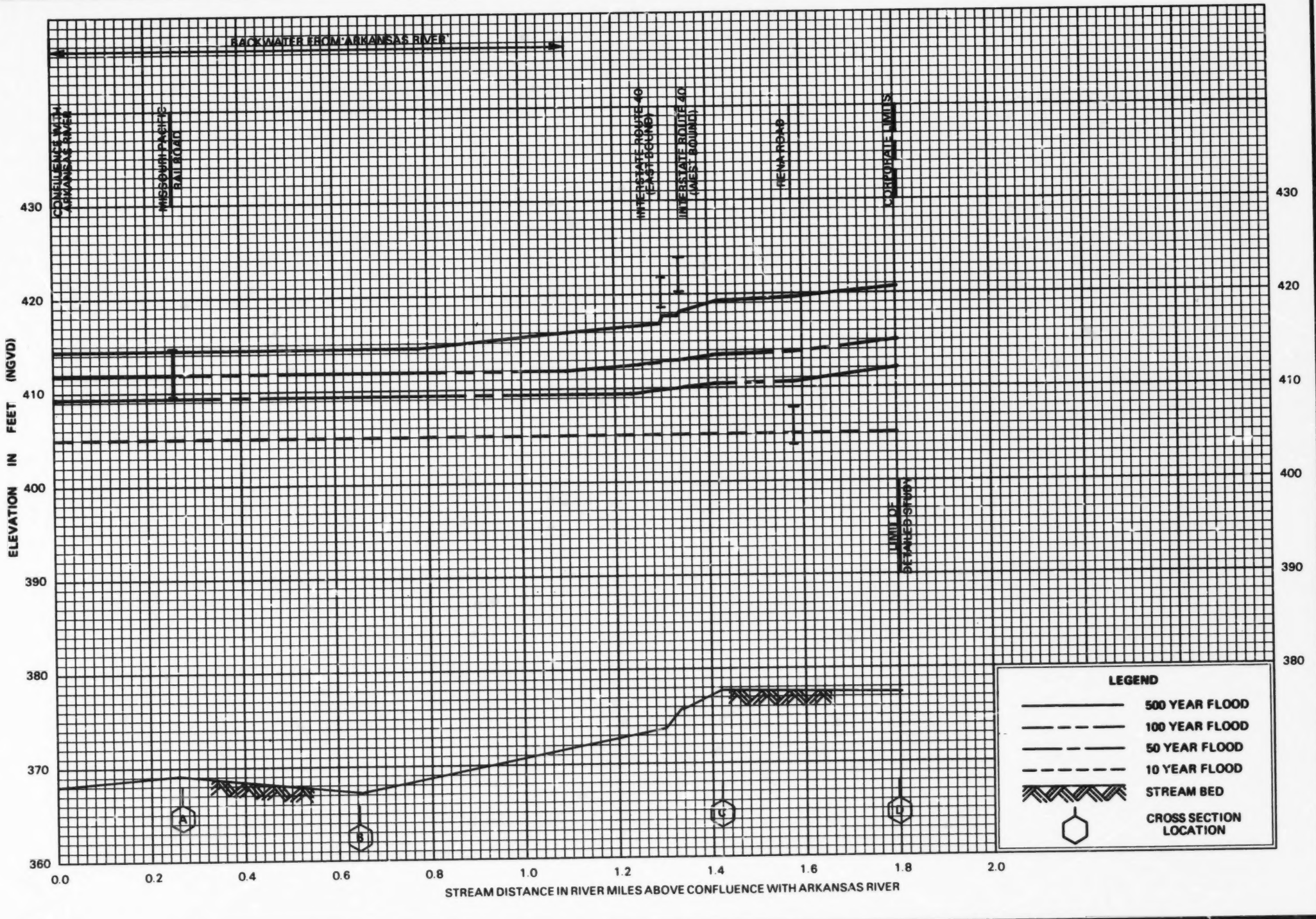
CITY OF VAN BUREN, AR
(CRAWFORD CO.)

07P

BEST COPY AVAILABLE



BEST COPY AVAILABLE



FLOOD PROFILES

LEE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF VAN BUREN, AR

CRAWFORD CO.)

09P

BEST COPY AVAILABLE